METHAMPHETAMINE: INCREASING NURSE PRACTITIONER AWARENESS

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Methamphetamine & Awareness

METHAMPHETAMINE: INCREASING NURSE PRACTITIONER AWARENESS

ABSTRACT

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Methamphetamine, commonly referred to as meth, is the third most frequently abused drug in the United States. It has been directly linked to memory loss, cardiovascular disease, malnutrition, psychotic behavior, and increased risk for HIV and Hepatitis. Much has been documented concerning meth's impact on communities, hospitals, emergency services and drug recovery services, very little has been written about the impact this drug has on the primary provider's practice. The purpose of this article is to assist the primary care provider gain understanding of meth's appeal across socioeconomic and geographic boundaries. It also provides a framework for early identification of those at risk and offers insight into health concerns and treatment issues that affect this population.
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Methamphetamine: Increasing the Nurse Practitioner Awareness

Methamphetamine, commonly referred to as “meth”, is the third most frequently abused drug in the United States. It has been directly linked to memory loss, cardiovascular disease, malnutrition, psychotic behavior, and increased risk for HIV and Hepatitis (Ferri, 2006). Comprehending the methamphetamine problem will assist the nurse practitioner in early identification of current and past users of the drug. Once believed to be a problem of the rural Caucasian male, current research reveals methamphetamine (meth) use crosses all socioeconomic barriers and geographic locations (Barr, et al., 2006). The lure of the drug has remained unchanged since it was developed in the late 1800s and users cite increased energy, euphoria, sharpened focus, and weight loss as justification for becoming involved with the drug (Neale, 2009). Methamphetamine places the user at high risk for multisystem health concerns and is often accompanied by high-risk behavior that increases co-morbidity for conditions including HIV, hepatitis and sexually transmitted diseases (Borders, Booth, Falck, & Leukefeld, 2009).

Much has been documented concerning meth’s impact on communities, hospitals, emergency services and addiction recovery but little has been written about the impact this drug has on the primary provider’s practice. It is estimated a general practitioner provides care for 80% of all patients seen each year in all healthcare settings including urgent care centers, health departments, private practices and publicly funded clinics (McAvoy, 2009). Consequently, identification,
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diagnosis, and management of meth users are generally the responsibility of primary care providers (Colyar & Call-Schidt, 2006).

The unique focus of the nurse practitioner (NP) to provide holistic care will benefit patients, families, and the community through early diagnosis, preventive care and counseling of the meth user and can facilitate access to treatment when appropriate (Winslow, Voorhees, & Pehl MD, 2007). Increased awareness of the extent of the problems related to meth will promote a heightened index of suspicion with patients. The purpose of this article is to assist NPs with information about meth, its widespread use, and the serious adverse effects. In addition, the article provides guidance when to screen for the drug and for managing the health concerns facing past and present users.

HISTORY OF METHAMPHETAMINE

Methamphetamine is not a new drug and Japan is credited with first synthesizing the drug from ephedrine in 1893 (Science Direct, 2009). Methamphetamine became widely employed in World War II, exploiting its sharpened focus, increased energy, and insomnia attributes to assist soldiers to remain on the front lines longer and pilots to fly lengthy and difficult missions (Scheve, 2008). Germany perfected a unique manufacturing technique that is utilized today in small home labs. The United States military continued to issue meth throughout the Vietnam War in numbers that surpassed the total quantity utilized by all forces in World War II.
In the 1950’s, prescription meth was on the rise in the U.S. for narcolepsy, Parkinsonism, alcoholism, depressive states and obesity (Barr, et al., 2006). The addictive property of the drug soon became apparent combined with the unfavorable side effects of cardiovascular collapse led to prescription use being curtailed. It was during that time that home labs and personal use markets grew as word spread about the euphoria users received from the drug. Today methamphetamine use crosses all socioeconomic boundaries, age groups, and cultural differences (Science Direct, 2009).

Meth is known by many names and is available in four recognizable forms at the street level (The Institute for Intergovernmental Research, 2009). Powder generally known as “speed” is of low purity and can be snorted, injected or taken orally. It is usually “cut”, or mixed, with other products (Winslow, Voorhees, & Pehl MD, 2007). “Base”, is a damp and oily paste of a higher purity than powder and is usually melted for injection or sometimes swallowed (Washington State, 2009). Pills exist on the street in the form of ecstasy, which is the weakest form of the drug and is usually blended with ketamine for an “ecstasy-like” effect (McAvoy, 2009). Ice, known as “crystal meth”, is the purest and most potent form of the drug, which is usually smoked or injected (Jones & Weir, 2008, McAvoy, 2009).

Pure methamphetamine hydrochloride, is called “LA Ice” because of its clear, chunky crystals that resemble frozen water. Other names include ice, crystal, crank, 64 glass, or quartz” (Law Enforcement. Quarterly, 2008). Street names delineate the methods used to either make the meth or the route to absorb the drug (Institute for
Intergovernmental Research, 2009). Meth may be named by the “cooker” or maker if he/she is famous or may be defined by color or characteristic for example; green meth is made with drano particles so it sparkles and is known as “christmas meth” [see Table I: Ingredients Used to Make Meth]. Other names that are randomly applied to Meth include: tina, glass, tweek, garbage, and wash (National Drug Intelligence Center, 2007).

**Epidemiology**

The U.S. Drug Enforcement Administration (2009) estimates that more than 11.5 million Americans have used methamphetamine at least one time. A National Drug Intelligence Center (2008) survey of high school students revealed 5% of all 11th graders who responded admitted to at least one time meth use. In 2005, over 1.5 million emergency department visits were directly linked to methamphetamine use (Lee, Vivier, & Diercks, 2009).

Meth use, considered an epidemic in many areas of the country and the world, began its most recent hold on the United States as a pacific coast drug being imported from Mexico through California and to the pacific northwest prior to spreading east to the mid-west region. While methamphetamine has impacted the entire pacific region, Washington has been distinguished as having nearly twice the number of methamphetamine labs reported than Oregon and exponentially more than Idaho and Alaska. Washington reported 951 labs compared to 474 in Oregon, 67 in Alaska, and 43 in Idaho by the 3rd quarter of 2004 (Department of Ecology [DOE]). This is significant as prior to the Oregon law requiring a prescription for
pseudoephedrine, Oregon led the region by an almost 2:1 ratio. In addition, Washington has the highest amount of federal drug seizures of methamphetamine in the pacific region (Drug Enforcement Agency, 2009).

A 2006 study reports the typical meth user as a caucasian male between the ages of 18-26 (Winslow, Voorhees, & Pehl MD, 2007). This has become the stereotypical picture of a methamphetamine user in the minds of most healthcare individuals however it is no longer accurate. Unlike other drugs, methamphetamine has shown to be as popular with women as men. Data from 2008 reveals an equal number of women as men have been admitted to treatment centers in the two preceding years for meth use (Gonzales, Mooney, & Rawson, 2009; Drug Enforcement Agency, 2009). In addition, a large study involving six large metropolitan areas showed that 13% of men having sex with men have used meth in the past 6 months. Methamphetamine use has been reported with disproportionately higher use in certain ethnic groups such as Pacific Islanders and American Indians (Winslow, Voorhees, & Pehl MD, 2007).

Meth rates in rural areas are hard to determine because most studies concentrate on metropolitan areas and collect data for emergency room and treatment admissions in city hospitals (Rural Assistance Center, 2005). Reported rates of methamphetamine use leveled between 2002 and 2006 while reported rates of dependence increased from 10.6% to 22.3%. This raises questions about data collection systems (Lee, Vivier, & Diercks, 2009). There is a large gap in the research on methamphetamine in part related to decreased federal funding between 2002 and 2006 when a decision was made to focus available monies on marijuana
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research (Borders, Booth, Falck, & Leukefeld, 2009). Since 2006 the number of users has begun to shift upwards again (Borders, Booth, Falck, & Leukefeld, 2009). The Drug Abuse Warning Network (DAWN) files annual statistics of emergency department visits tracking admissions for drug and alcohol related primary concerns. Its data demonstrate an increase in admissions by 20% for individuals requiring treatment from primary meth related issues.

**Pharmacodynamics**

Methamphetamine is a synthetic and potent form of a drug linked closely to amphetamines. The differences between methamphetamine and amphetamines explain the high addiction properties of meth as well as the length of time it remains in the user's system. The methyl group of the drug is most likely responsible for the potentiating effects of meth when compared to amphetamines (Graber, 2007). Meth is more lipid soluble and easier to transport across the blood brain barrier than regular amphetamine compounds. It also has less enzymatic degradation by monoamine oxidases (Institute for Intergovernmental Research, 2009). This means that the 5HT Transporters (norepinephrine, dopamine and serotonin) are not only being released at a much higher rate than normal, but are also left in circulation for a much longer period of time.

Methamphetamine, a member of the family of phenethylamines, activates the central nervous system and the peripheral sympathetic nervous system (Burke, Perrochet, & Dawud-Noursi, 2000). It is a potent central nervous system stimulant that affects neurochemical mechanisms responsible for regulating heart rate, body temperature, blood pressure, appetite, attention, mood and responses associated
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with alertness or alarm conditions (Jones & Weir, 2008). Meth increases synaptic concentrations of the excitatory neurotransmitters dopamine, norepinephrine, and serotonin by a two fold process. First, there is an increased release of neurotransmitters from storage sites in nerve terminals. Second, methamphetamine inhibits reuptake by blocking the transporters responsible for removal of the neurotransmitter molecules from the synaptic cleft.

The result of methamphetamine increasing synaptic levels of the neurotransmitters dopamine, serotonin (5-HT) and norepinephrine is both an alpha and beta adrenergic agonist effects. Dopamine stimulates locomotor effects, psychosis, and perception disturbances and 5-HT is responsible for delusions and psychosis. The norepinephrine causes meth to have alerting, anorectic, and sympathomimetic effects (Lacy, Armstrong, Goldman, & Lance, 2009-2010).

Pharmacokinetics

The peaks and half-lives of different forms of meth vary with the route of administration. Almost all forms of meth have a rapid onset of effects with the smokable forms being immediate (Romanelli & Smith, 2007). Oral administration peaks in 2.5-3.5 hours and has an elimination half-life of approximately 10 hours (range of 6.4-15 hours). Intravenous administration leads to a slightly longer mean half-life of 12.5 hours (Jones & Weir, 2008). The half-lives of the snorted or smoked varieties of meth are difficult to establish as concentrations and additives make it difficult to determine but the half-life is estimated to be in the range of 10 hours. Between 30% and 40% of meth is metabolized by the liver with the
remaining 60%-70% excreted by the kidneys (Lacy, Armstrong, Goldman, & Lance, 2009-2010).

Prescription Methamphetamine

Desoxyn is a class II drug and the only legal form of methamphetamine (Lacy, Armstrong, Goldman, & Lance, 2009-2010). It can be prescribed for ADHD that is resistant to other medications and obesity (Lacy, Armstrong, Goldman, & Lance, 2009-2010). When used for obesity, it increases metabolism and acts as an appetite suppressant. It is only available as a brand name drug in 5 mg tablets from Ovation Pharmaceuticals. The manufacturer did not respond to an inquiry regarding the volume of prescriptions of this medication. Pharmacists at four of the major pharmacy chains in the Portland, Oregon area reported in a telephone conversation that Desoxyn is not stocked nor have they had a request for it. In addition, Desoxyn was not on a list of drugs available to order (P. Tallon, personal communication, December 28, 2009).

EFFECTS OF METHAMPHETAMINE USE

Psychological Effects

Methamphetamine has been proven to exacerbate symptoms of behavior disturbance and thought disorders in patients. Individuals with a history of bipolar disorder, suicidal ideation, and depression using meth will most likely compound the symptoms of their disorders. Aggressive behavior has been well documented in multiple studies of chronic stimulant users and exponentially increases with
methamphetamine due to the prolonged half-life. The findings of the research show a well documented association with prolonged use of methamphetamine and an increase of psychiatric symptoms including: anxiety, paranoia, hallucinations and psychosis (Wu, Schlenger, & Galvin, 2006; Huff, 2006; Jones & Weir, 2008).

The central nervous stimulating (CNS) effects of methamphetamine cause euphoria, inflated confidence and a sense of prowess for physical activity as well as decreased inhibition (Ferri, 2006). In addition, improved cognitive and physical performance, suppression of appetite and reduced need for sleep are a few of the effects cited as part of meth's appeal (Borders, Booth, Falck, & Leukefeld, 2009). Studies link the prolonged use of meth with the decrease in dopamine transporter density in the brain leading to a depletion of dopamine stores. Dopamine plays a critical role in central nervous system as well as the brain's mechanism for motivation and reward (Diercks, Boghos, & Weber, 2007). In addition, the transporter reduction may be long lasting even if the methamphetamine use is discontinued. The reduction of dopamine transporter density may also lead to persistent adverse psychiatric symptoms directly linked to the continual use of methamphetamine (Yoshimoto, et al., 2001).

Short-term psychological effects of meth use include dysphoria and overstimulation. Tactical hallucinations produced by the drug produce the well documented and well known side effect of "bugs crawling" on the skin which can lead to chronic picking and scratching the arms, chest face and abdomen (Diercks & Kirk, 2007). Symptoms similar to Attention Deficit Hyperactivity Disorder (ADHD)
behaviors, Parkinson's like tremors and psychosis are linked to the prolonged effects of meth (Burke, Perrochet, & Dawud-Noursi, 2000).

**Physiological Effects**

One of the most common problems resulting from methamphetamine use is a condition referred to as "meth mouth", the dental carries typical among users. Much of the research from the late 1990s through 2002 suggested that meth caused the salivary glands to dry, which in turn allows the acids in the mouth to erode the enamel causing accelerated decay. More recent research indicates that the combined effects of poor dietary choices, dry mouth, decreased blood flow to the oral mucosa, and poor dental hygiene is the culprit (Shaner, Kimmes, Saini, & Edwards, 2006).

The most undisputed side effect of methamphetamine use is the drug's impact on the cardiovascular system. The sympathetic system stimulation resulting from catecholamine release is responsible. Direct correlations have been made between increased levels of methamphetamine and increased risk for cardiac disease, dissecting aortic aneurysm, hypertension, and peripheral vascular disease (Diercks, Boghos, & Weber, 2007; Lee, Vivier, & Diercks, 2009; Miller & Coon, 2006). (Dye, 2006). The peripheral sympathetic nervous system (PSNS) is affected by meth increasing blood pressure, tachycardia or a reflex bradycardia, increased temperature and cardiac arrhythmias (Ferri, 2006). Muscle tremors known as "tweaking" are also attributed to the PSNS [see Figure 1: Effects of Meth].
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Systems throughout the body are impacted by methamphetamine including circulatory issues, liver damage, kidney damage, convulsions and loss of coordination (Winslow, Voorhees, & Pehl MD, 2007; Subcommittee on Criminal Justice, Drug Poli and Human Resources, 2006; Ruha & Yarema, 2006; Graber, 2007; Borders, Booth, Falck, & Leukefeld, 2009). Skin is affected by methamphetamine use as blood vessels constrict, causing dryness and increased appearance of age along with the “picking” users tend to do resulting from tactical hallucinations of “bugs crawling” mostly on exposed surfaces. This incessant “picking” along with injecting the drug, increases the meth user’s exposure to Methicillin Resistant Staphylococcus Aureus (MRSA) skin infections.

RAISING THE INDEX OF SUSPICION

'Red Flags' for possible meth use

Methamphetamine users may seek health care for problems that may seem benign. These include: insomnia and asking for sleep aids, anxiety and requesting benzodiazepines, and erectile dysfunction as meth decreases the ability to maintain an erection. Meth users may request narcotics for unspecified pain to numb the drug cravings or generalized joint aches meth causes (Romanelli & Smith, 2007). Dental carries related to the perpetually “dry mouth” that users of meth experience may be an early indicator of abuse. Unexplained weight loss should raise an index of suspicion to new or ongoing meth use.

Concurrent and untreated depression, psychosis, ADHD and other addictions may be masked by the use of meth as patients attempt to self medicate. It is
estimated that one third of all users of meth have an underlying and untreated psychiatric illness (Barr, et al., 2006). Psychosis associated with meth use may present in the forms of delirium, paranoia, acute anxiety and the tactile hallucination in acute intoxication of methamphetamine (Ferri, 2006). Associated movement disorders are also linked to prolonged use of methamphetamine and include: acute dystonic reactions, choreathetosis and akathisia (crack dance), buccolingual dyskinesias (twisting of the mouth or tongue movement) and tardive dyskinesias (involuntary repetitive movements) (Graber, 2007). Documented sexually transmitted infections, HIV infection and hepatitis associated with risky sexual behavior add to provider's index of suspicion as well as the need for testing for these diseases once a user is identified (Borders, Booth, Falck, & Leukefeld, 2009).

**Screening**

A search of Pub Med, Cinahl, Medline, and First Alert has for specific guidelines for screening patients for methamphetamine did not yield any results. The U.S. Preventive Services Task Force found insufficient evidence to recommend for or against routine screening for any drug use by history or diagnostic testing (US Preventive Service Task Force). The decision to screen a patient for meth use is at the discretion of the provider. Diagnostic testing with informed consent has been found to be useful in patients with stimulant-associated symptoms or those considered high risk.
There are several options available to providers that include screening for addictive behaviors and use of psychiatric screening tools. The screening tools include the Folstein Mini-Mental Exam; the CAGE & RAFFT which are four and five question surveys; the Substance Abuse Subtle Screening Inventory (SASSI-3); and the six-question survey UNCOPE (Huff, 2006; Gonzales, Mooney, & Rawson, 2009). These five tools are readily available in the literature as well as from multiple sites on the Internet, though some require purchase. "Project CORK", maintained by Dartmouth University, provides a searchable database of over 85,000 clinical instruments, bibliographical data and evaluation tools used for screening for alcohol and drug abuse as well as several mental health issues (Dartmouth Medical School, 2010). No specific tool is recommended and selection is based on provider preference and comfort. It is estimated that one third of all meth users have an unidentified psychiatric illness and screening for these illness may assist in identifying individuals at high risk for meth use (Diercks, Boghos, & Weber, 2007).

Another recommendation to screen for meth use includes the use of direct, open ended, non-judgmental questions inquiring about the use of drugs and then becoming more specific to patterns of use or abuse of methamphetamine. An example of this interview style would be: "Can you tell me about the last time you used any stimulant drugs such as methamphetamine, amphetamine, cocaine, ecstasy, crank, crack or any other substance" (Institute for Intergovernmental Research, 2009). Depending on the response, this question could be followed with, "How many times a week do you find yourself using meth?" This technique has been found to provide more forthright responses then simply asking "Do you use
meth?” which may be interpreted as aggressive and judgmental by a percentage of users of the drug (Neale, 2009).

If screening questions suggest that laboratory testing is indicated, there are three tests to consider. Methamphetamine can be detected in urine for up to 72 hours depending on the test and for several weeks with a hair follicle test. Saliva testing is stated to be accurate from 10 minutes after ingestion to 72 hours (Diercks, Boghos, & Weber, 2007). The provider should be aware that there are Internet sites with lists of over-the-counter (OTC) medications that will lead to false positive tests. It is well documented that pseudoephedrine will cause a false positive for amphetamine. If a positive test is obtained, a patient may tell a provider he or she used one of these OTC medication to dismiss the test’s validity. A confirmatory test can be done specific to methamphetamine (Diercks, Boghos, & Weber, 2007).

The “red flags of meth use” can also be considered as a screening tool. Sudden physical changes including an increase in dental carries, complaints of chronic dry mouth, and sudden weight loss are some of the early signals a provider may encounter (Burke, Perrochet, & Dawud-Noursi, 2000). Providers may perceive an inappropriate aging appearance to a meth user or abuser as poor nutritional intake decreases the elasticity, and changes the texture, of the skin. Any combination of physical or psychological symptoms could lead a provider to pursue drug testing or psychological testing.

_Treatment for meth use_

It is necessary to establish if the patient is willing to engage in treatment for meth abuse and to provide contacts for available resources in the community.
Treatment of meth use and abuse may be a two-fold process that involves management of the craving for meth and the residual physical and psychological effects left my meth (Grabber 2007). Treatment options for methamphetamine addiction will depend on the NP's area of practice and the availability of resources. Treatment of acute symptoms associated with meth use and withdrawal and close monitoring is recommended (Washington State, 2009). Generally, outpatient therapy combining behavior modification, ongoing support, and supervision is required for success. These models are showing greater promise when treatment is extended for 6 months (Neale, 2009).

There is no specific treatment approved for methamphetamine withdrawal. There is conflicting information concerning the effectiveness of medications in the treatment of abuse. Prozac may decrease cravings. Tofranil is suggested to improve adherence to therapy in very low doses, however, as a tricyclic its use is controversial, and Wellbutrin has shown limited promise with craving reduction and increased adherence to therapy (Winslow, Voorhees, & Pehl MD, 2007; Subcommittee on Criminal Justice, 2006; Drug Policy and Human Resources, 2006). Again, none of these medications have been proven effective nor are recommended.

Management of the Identified Meth User

Once methamphetamine use is identified, laboratory testing may be required. This includes sexually transmitted disease and HIV testing, a comprehensive metabolic panel and relevant preventive and diagnostic tests (McAvoy, 2009). Ongoing assessment to identify the presence of cardiovascular disease or injury
with appropriate treatment is a high priority as the research is clear that meth has a significant impact on the cardiovascular system (Mooney, et al., 2009).

Utilizing urine drug screening for patients that are seeking medications for “red flag” issues is an option provided caution interpreting the results is utilized. A negative result does not eliminate the possibility that a person is using meth, only that it was not detectable at the time the test was conducted. A positive test does not determine the frequency with which a person is using meth (Jones & Weir, 2008). Incorporating preventive teaching from the first encounter with all patients and providing materials explaining the medical issues associated with drug use as well as the addictive properties of drugs may be helpful in establishing a provider client relationship. A trusting relationship with the patient can foster open communication and truthful disclosure when issues arise and to assess the patient’s willingness to complete referral appointments and commitments.

Dental intervention will be imperative to decrease the spread of carries and preserve dentition. Immediately, the provider should begin education focused on oral hygiene and consider the potential for nutritional deficits related to poor dentition as well as infections while awaiting a dental referral. Early recognition and treatment of dental issues will not only decrease sources of infection and assist with nutritional intake but will also aide in increasing self esteem during the recovery process (Graber, 2007).

Prescribing medications that interact with methamphetamine should be avoided. Other stimulants or medications that would enhance catecholamine activity, such as adrenaline, norepinephrine, and dopamine are contraindicated
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(Burke, Perrochet, & Dawud-Noursi, 2000). These interactions would cause overstimulation of the sympathetic nervous system possibly leading to cardiac arrhythmias, hypertension, seizures, cardiovascular collapse, and death (Ferri, 2006). More importantly, monoamine oxidase inhibitors should not be prescribed until methamphetamine has not been used for two weeks (Graber, 2007). Tricyclic antidepressants, which can potentiate the effects of methamphetamine by enhancing its gastrointestinal absorption and slowing its liver metabolism, are also contraindicated (Graber, 2007).

CONCLUSION

The increased use of methamphetamine requires that primary care providers keep a high index of suspicion and a questioning mind to accurately diagnose and treat patients. The research is clear that no single method currently in use for screening or identification of meth use has proven effective. Use of screening tools for substance abuse and depression, establishing a trusting relationship, and a thorough history and physical will prove most advantageous to the clinician in identifying individuals at risk for meth use.

Methamphetamine use is a persisting and complex issue that will impact all providers’ practice on some level. The nurse practitioner’s practice is often hectic and patient contact is limited by appointment constraints. Using the nursing model to achieve a non-judgmental approach in dealing with patients will hopefully allow for honest disclosure by patients (McAvoy, 2009). Providers must not be afraid to directly ask their patients if they are involved in drug activity or high-risk behaviors. Including questions that are specific to methamphetamine. The numbers speak for
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themselves as to the increasing problem meth presents. Once methamphetamine use is determined or suspected, the practitioner should not hesitate to drug screen patients when necessary especially if prescribing medications that would be effected by the patients recreational drug use.
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References


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### Ingredients to Make Methamphetamine

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<td>Pseudosphedrine</td>
<td>Cold medicines</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Abuse, Heart Failure</td>
</tr>
<tr>
<td>Red Phosphorus</td>
<td>Matches, fireworks</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>Unstable, Flammable</td>
</tr>
<tr>
<td>Sodium Hydroxide</td>
<td>Drain cleaners, lye</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>Burns, Skin Ulcers</td>
</tr>
<tr>
<td>Sulfuric Acid</td>
<td>Battery Acid</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>Burns, Thyroid Damage</td>
</tr>
<tr>
<td>Toluene</td>
<td>Paint, thinners, solvents</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>Fetal Damage, Pneumonia</td>
</tr>
<tr>
<td>Liquid Lab Waste</td>
<td>None</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Unknown long term</td>
</tr>
</tbody>
</table>

Obtained from the Riverside County Police Web Page; http://dec.co.riverside.ca.us/fyi/hazards.htm

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### Table 1

**Effects of Methamphetamine Use**

**SHORT-TERM EFFECTS**
- Brief rush
- Hyper-vigilance
- Hyperactivity
- Irritability
- Paranoia
- Decreased appetite
- Increased libido
- Repetition of meaningless tasks
- Dilated pupils
- Increased respiration
- Heavy sweating
- Hyperthermia
- Dry mouth, bad breath
- Uncontrollable jaw clenching
- Cracked teeth
- Headache
- Sleeplessness
- Nausea, vomiting, diarrhea
- Sores, skin infections, acne
- Hypertension
- Risk of seizures
- Violent behavior

**LONG-TERM EFFECTS**
- Repetitive motor activity
- Confusion
- Visual/auditory/sensory hallucinations
- Mood disturbances
- Aggressive behavior
- Social/occupational deterioration
- Anxiety/paranoia
- Homicidal/suicidal thoughts
- Out-of-control rages
- Psychosis
- Hypertension
- Damage to small blood vessels
- Decreased sexual function
- Extreme weight loss
- Insomnia
- Fatigue
- Intense drug craving
- Dependence/addiction
- Reduced disease resistance
- Tooth decay
- Lead poisoning
- Heart infections
- Lung disease
- Kidney damage
- Liver damage
- Brain damage (symptoms of dementia)
- Risk of stroke

Data extracted from: (Drug Enforcement Agency, 2009)
Adverse (negative) effects of Methamphetamine

Psychological
- Insomnia
- Aggressive behavior
- Paranoia
- Incessant conversations
- Decreased appetite
- Increased alertness
- Irritability
- Skewed speech
- Dizziness
- Confusion
- Hallucinations
- Obsessive behaviors
- Depression
- Panic attacks

Systemic
- Hyperthermia
- Malnutrition
- Impaired immune system

Circulatory
- High blood pressure
- Vessel damage in brain
- Clotting and stroke

Heart
- Chest pain
- Rapid heart rate
- Heart attack

Liver
- Damage

Eyes
- Dilated pupils

Mouth
- Grinding of teeth

Skin
- Sweating
- Numbness

Respiratory
- Shortness of breath
Muscular
- Jerky movements
- Increased activity
- Convulsions
- Loss of coordination

Kidneys
- Damage

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